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Benchmark Hohlraum Simulations Enabled by NLTE Kinetics on GPUs[1] MEHUL V. PATEL, HAI P. LE, HOWARD A. SCOTT, JAY D. SALMONSON, JOSEPH M. KONING, CHRISTOPHER V. YOUNG, STEVEN H. LANGER, Lawrence Livermore National Laboratory — Predicting the X-ray drive in hohlraums at the National Ignition Facility (NIF) has proven to be a challenge for radiation-hydrodynamics simulations. Uncertainties in modeling the non-local thermodynamic equilibrium (NLTE) state of the high-Z wall plasma could explain a significant fraction of the modeled drive discrepancy. Previously, we showed how improved hohlraum energetics predictions are achieved by performing inline atomic kinetics using more complete models for the underlying atomic structure and transitions. Because of their 100x computational expense (both in operations and memory), using our most complete atomic models for inline radiation hydrodynamics calculations had only been practical for 1D simulations. Using the GPU processing power on the latest generation of supercomputers (Sierra at LLNL), we have overcome this limitation and report the first set of highly resolved 2D hohlraum simulations using our most complete DCA atomic models. The improved near-LTE opacities allow for a physics-based, smoother transition from LTE to NLTE. These simulations also provide valuable benchmark data for complementary off-line approaches (e.g. steady-state NLTE tables).

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